# Ruptured Cervical Intervertebral Discs

C. HUNTER SHELDEN, M.D., and ROBERT H. PUDENZ, M.D., *Pasadena*

*SUMMARY*

*Intractable pain in the neck and upper extremity is frequently radicular in character and mechanical in origin. Rupture of a cervical intervertebral disc is the most common cause.*

*Diagnosis and localization are more difficult in the cervical than in the lumbar region. Pantopaque myelogram should be considered only as a mean of localization. Operation should be preceded by a thorough trial of conservative treatment.*

RUPTURED intervertebral discs in the cervical region present considerably different problems in diagnosis and surgical management than do similar lesions in the lumbar area. The factors which add to the complexity of the problem in the cervical region are largely anatomical in nature. The vertebral column in the cervical region contains not only the nerve roots but also the spinal cord. Consequently, the symptoms may result from involvement of the nerve root or of the spinal cord or of any combination of these two structures. Other factors are the greater mobility of the cervical spine and the more localized cutaneous representation of the individual nerve roots in the neck than in the lumbar region. Motor disability, when present, is more pronounced in view of the greater specialization of individual muscles in the upper extremity.

Another anatomical factor which increases the complexity of diagnosis in the upper extremity is the formation from the cervical nerve roots of the brachial plexus along the path of which are many important structures, such as the scalenus anticus muscle, the subclavian artery, the clavicle and the pectoralis major muscle, as well as the first rib. All of these structures are theoretically capable of producing irritation to the brachial plexus with clinical signs which may be difficult to distinguish from those of a radicular lesion.

## SYMPTOMS

Theoretically, rupture of an intervertebral disc can occur at any level in the cervical spine. However, as in the lumbar region, there are certain sites of predilection. The most frequent sites of rupture are between the fifth and sixth and between the sixth and seventh cervical vertebrae. Since there are seven cervical vertebrae and eight cervical nerve roots, the root which takes exit between the fifth and sixth cervical vertebrae is the sixth cervical root. That between the sixth and seventh cervical vertebrae is designated as the seventh cervical root. Compression of either root produces a clinical picture which permits accurate neurological localization.

Mechanical lesions involving the nerve root produce motor and sensory findings of radicular character, in contradistinction to the motor and sensory findings produced by a lesion affecting a peripheral nerve.

Irritation of the sixth cervical root produces symptoms in the distribution of both the radial and median nerves corresponding to those fibers in the peripheral nerve which take their origin from this nerve root alone. When the sixth cervical root is irritated by mechanical pressure, the sensory findings are limited to numbness and paresthesias involving the thumb, first and second fingers. The pain accompanying such a lesion, however, may vary widely in distribution. It generally affects the area between the vertebral margin of the scapula and the vertebral column, the region over the anterior pectoralis major muscle, in the precordial region, as well as the neck, shoulder, upper arm and along the radial aspect of the forearm. The pain generally does not extend into the fingers. Weakness is usually confined to the triceps muscle.

When the seventh cervical root is irritated, the sensory findings of numbness and paresthesias involve chiefly the third and fourth fingers. The motor loss involves not only the triceps muscle but also the extensors of the wrist and fingers. The pain associated with seventh root compression is more often limited to the shoulder, arm and forearm.

The onset of symptoms varies greatly in individual patients. Frequently there is a history of recurrent attacks of stiffness of the neck associated with pain and muscle spasm, but no evidence of radiation into the arm or forearm. Months or even years later, the sudden onset of severe radicular pain involving the arm may be precipitated by some physical effort such as lifting, coughing or sneezing. Symptoms occur in attacks of short duration, usually followed by a period of more or less complete freedom. Attacks tend to become more frequent in occurrence with extension of pain into the neck, shoulder and, later, the arm and forearm. The attacks recur on the same side with symptoms appearing in identical areas with each attack. Frequently the patient complains only of pain and numbness, being unaware of the presence of any muscular weakness. During an acute attack, any muscular effort involving the neck or arm may be extremely painful. Likewise, in most

Presented before the Section on Industrial Medicine and Surgery at the 78th Annual Session of the California Medical Association, Los Angeles, May 8-11, 1949.

radicular lesions, coughing, sneezing or straining may aggravate the pain. Night pain, particularly between two and four o'clock in the morning, is common.

### DIFFERENTIAL DIAGNOSIS

A ruptured intervertebral disc in the cervical region may present difficulty in diagnosis because of the greater number of important structures which must be considered as etiological factors. Lesions which must be considered in the differential diagnosis are cervical arthritis, scalenus anticus syndrome, cervical rib, old fracture of the clavicle and, if the pain is on the left side, coronary heart disease.

Symptoms produced by a ruptured intervertebral disc are often attributed to the presence of radiologically visible arthritis of the cervical spine. It is true that arthritis may produce radicular symptoms, but usually these are not confined to one upper extremity. A compression syndrome involving one nerve root should not be attributed to primary cervical arthritis without thorough neurological investigation.

The scalenus anticus syndrome is without doubt a clinical entity, but it does not exist anatomically nearly as often as it is diagnosed clinically. The primary feature of this syndrome is compression of the subclavian artery, with pain a secondary factor. Without objective evidence of vascular disturbance, the diagnosis should be made with caution. Obliteration of the radial pulse should be readily demonstrable and limited to the side of the clinical symptoms. Section of the scalenus anticus muscle for pain alone, particularly when limited to the radial aspect of the hand, seldom results in relief of symptoms.

The presence of a cervical rib on the side of the pain and paresthesias may make the differential diagnosis difficult. It is helpful to recall that the site of the mechanical irritation caused by a cervical rib involves the brachial plexus directly; hence the distribution of pain and paresthesias is more widespread than can result from compression of a single nerve root. If, after adequate investigation, doubt still exists concerning the essential lesion, it is better clinical judgment to resect the scalenus anticus muscle first, since this procedure is less formidable than cervical hemilaminectomy.

Poorly united fractures of the clavicle are liable to produce excess callus formation, particularly on the under surface. Such lesions have been observed to produce very localized areas of pain and paresthesia in the upper extremity. Old fractures of the first rib with callus formation likewise may produce a point of mechanical irritation to the brachial plexus. Wide resection of that portion of the clavicle or first rib results in complete relief of symptoms.

Suspected coronary heart disease may lead to confusion in diagnosis when the radicular symptoms are limited to the left side. This is particularly true when the sixth nerve root is involved, since pain may be limited to the anterior pectoral region on the left with radiation into the left upper arm. Patients having recurrent attacks of severe pain, without other features of angina and with repeatedly normal electrocardiograms, should be considered as having a ruptured intervertebral disc. The presence of muscular weakness in the triceps or extensors of the wrist and fingers should be of definite aid in establishing a correct diagnosis.

Lesions more nearly in the midline affect primarily the spinal cord and must be differentiated from spinal cord tumor, multiple sclerosis, primary lateral sclerosis and syringomyelia.

The most consistent diagnostic feature of spinal cord tumor, early in its course of development, is the presence of symptoms and signs gradual in onset and progressive in character. A history of trauma is usually lacking, as well as recurrent acute attacks of pain and muscle spasm in the neck. Night pain is a characteristic symptom of spinal cord tumor. Frequently pain awakens the patient from a sound sleep and is relieved if the patient gets out of bed and walks about the room. Pyramidal and spinothalamic tract signs may be present in either type of lesion, but the history of steady progression is seldom present with ruptured intervertebral disc.

Primary lateral sclerosis should offer little difficulty in diagnosis because the pyramidal tracts are the only portion of the spinal cord affected. Exaggerated deep tendon reflexes, increased muscle tone and positive Babinski signs without sensory impairment are diagnostic.

Multiple sclerosis is characterized by remissions and exacerbations of clinical signs and symptoms. The cardinal features of this syndrome are nystagmus, pronounced incoordination and pyramidal tract signs. The history of old retrobulbar neuritis, appearing even years before the onset of other symptoms, may afford a clue to the proper diagnosis.

Primary cavitation of the spinal cord should offer little difficulty in differential diagnosis because of the long history, the muscular atrophy, as well as the presence of a well-defined zone of disassociated anesthesia corresponding to the area of involvement of the spinal cord.

The diagnosis of ruptured intervertebral disc should be made by clinical means. No special laboratory procedures can take the place of careful history taking and neurological examination. Special diagnostic procedures such as x-rays, electromyogram, lumbar puncture and Pantopaque® myelography should be employed to eliminate the etiological possibilities and to localize the actual site of the lesion.

Roentgenograms of the cervical spine should be taken routinely. They should include three-quarter views of the spine and a projection through the mouth as well as the routine anteroposterior and lateral views. X-ray findings associated with ruptured intervertebral disc include the loss of the usual cervical curve, a point of localized narrowing of the intervertebral disc, and hypertrophic changes of the adjacent vertebrae. Frequently, these localized hypertrophic changes are considered as primary

cervical arthritis, but in all probability they represent a secondary reaction of the adjacent vertebrae to an abnormal mechanical factor at the level of the ruptured intervertebral disc. In normal circumstances the intervertebral disc has a very high water content, and consequently any motions of the cervical spine produce a distribution of force which follows a hydrostatic principle. Secondary to degeneration of the intervertebral disc and subsequent rupture, there results a decrease in the water content of the disc. Motion of the cervical spine then produces a stress and strain on the adjacent vertebrae which follows a mechanical rather than a hydrostatic principle. In such circumstances, forward motion of the cervical spine results in far greater force being placed upon the anterior margin of the vertebrae, and over a period of time there result hypertrophic changes, particularly along the anterior margins of the adjacent vertebrae, which account for the localized changes so frequently seen in association with a rupture of one of the cervical intervertebral discs. It would seem most unlikely to find a far advanced arthritic process limited to two adjacent vertebral bodies without some evidence of involvement of the remaining cervical spine.

The electromyogram has recently proved to be of great value in the differential diagnosis, particularly of those lesions which affect the motor component of the nerve root. A careful electromyographic examination will reveal evidence of lower motor neuron disease as demonstrated by the presence of fasciculation in the individual muscles supplied by the motor component of the involved nerve root. This excellent adjunct to neurological diagnosis has not been fully investigated. However, the authors believe that the presence of positive electromyographic evidence affords a reliable means of localization.

The value of lumbar puncture and careful cerebrospinal fluid investigation cannot be overemphasized. The procedure is done with the patient in the horizontal position. The needle should be introduced carefully to prevent blood contaminating the spinal fluid. Determination of the initial pressure and the response to jugular compression are carried out as a routine procedure. A complete examination of the spinal fluid obtained should be done without delay. The most important spinal fluid examination in the diagnosis of ruptured intervertebral disc is the determination of the total protein. An elevation of the total protein generally signifies a lesion producing nerve root or direct spinal cord irritation.

Myelography has proven to be of great value, but it should be considered as a method for accurate localization of the lesion and not employed to replace clinical diagnostic procedures. The accepted medium used at present is Pantopaque. All too often myelography has been used as the first method of investigation rather than the last. Cervical myelography is a difficult procedure and should not be attempted by those unfamiliar with fluoroscopic technique.

## TREATMENT

The proper care of individuals with intractable pain in the upper extremity requires careful clinical judgment. It must be remembered that not every pain in the shoulder and arm results from ruptured intervertebral disc. Other types of neuritis occur which are not of a mechanical nature. Careful clinical investigation should be made to exclude sites of focal infection. Referred pain from a ligamentous lesion adjacent to the spinal vertebral column may simulate a radicular syndrome. When not to operate is as important in this as in any other surgical problem. It would seem safe to state that no patient should be operated upon during the first attack of pain, no matter how severe, without first having conservative treatment. This should consist of heat, physical therapy and traction. Oftentimes even skeletal traction is necessary in order to obtain sufficient pull without discomfort to the patient. It is probable that over 90 per cent of individuals will obtain complete relief in the first or even subsequent attacks by such conservative procedures.

The indications for operation are failure to obtain benefit by conservative means, the appearance of pronounced increase in the positive objective neurological findings, or the development of spinal cord signs.

The actual surgical removal of the ruptured intervertebral disc is not difficult. It is purely a mechanical problem consisting of the location and removal of the offending fragment, which is generally located far laterally beneath the nerve root at the level of the involved intervertebral disc. Removal is best accomplished under general intratracheal anesthesia with the patient in a sitting position. Both the midline incision and partial hemilaminectomy should be adequate to allow proper exposure. Thus, removal of the fragment may be accomplished without damage to the nerve root or the adjacent spinal cord. The approach is extradural. The dura itself is not opened except in rare instances, because the presence of spinal fluid serves as a hydrostatic buffer which protects the spinal cord.

The lesion may appears as a bulging of the posterior longitudinal ligament or as a complete rupture through the ligament into the extradural space. Frequently an area of bony reaction is found about the margin of the herniated portion of the disc material, and it is generally advisable to remove the area of bony reaction as well as the cartilaginous material. After removal, the wound is closed in layers without drainage.

No special postoperative care is necessary, and patients are allowed out of bed on the first or second day.

Complete relief of symptoms can be anticipated if adequate care is exercised in the selection of patients for operation.

696 East Colorado Street.